GOLF CLUB HEAD AND MANUFACTURING METHOD THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a golf club head. In particular, the present invention relates to a golf club head including a heel that has an opening defined therein for improving casting quality of the golf club head. The present invention also relates to a method for manufacturing the golf club head.

2. Description of Related Art

Fig. 1 is a pattern assembly for manufacturing a conventional golf club head. Fig. 1A is another pattern assembly for manufacturing a conventional golf club head. Fig. 2 is a front view of a conventional golf club head. Fig. 2A is an enlarged view of a circled portion in Fig. 2. A typical casting procedure for manufacturing a golf club head includes producing a wax pattern having a predetermined golf club head shape and immersing the wax pattern in zirconium slurry and stucco to form a pattern assembly 10 that has a plurality of molds 11 each having a mold cavity 12. The mold cavities 12 of the molds 11 are then heated to release wax, and molten iron is poured into the pattern assembly 10 via at least one inlet 13 of the pattern assembly 10 for manufacturing a casting of a golf club head 20. As illustrated in Fig. 2, the casting of the golf club head 20 includes a body 21, a hosel 23, and a heel

22. The heel 22 is generally thicker than the body 21 and the hosel 22. Thus, as illustrated in Fig. 1A, if the pattern assembly 10 has only one inlet 13, the molten iron has a poor molding flow property in an area in the mold cavity 12 corresponding to the heel 22, resulting in casting flaw on the surface of the heel 22 of the casting of the golf club head 20 (see the shrinkage cavities 22a in Fig. 2A). To mitigate the casting flaw, it is usual in the art to provide at least two inlets 13 (see Fig. 1) in each mold 11 to provide a better molding flow property for the molten iron in the cavity 12, thereby improving the casting quality of the heel 22.

However, in a case that a pattern assembly 10 with at least two inlets 13 is used, two molding flows flowing in different directions are apt to form in the mold cavity 12, prohibiting uniform alignment and solidification of crystalline grains, which adversely affects mechanical properties of the casting of the golf club head 20 and thus could not avoid generation of the casting flaw in the heel 22. Further, the number of the molds 11 of the pattern assembly 10 is limited if each mold 11 has at least two inlets 13. The production capacity per time unit or per space unit is reduced.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a golf club head with improved casting quality.

Another object of the present invention is to provide a golf club head that can be manufactured at an increased production rate.

A further object of the present invention is to provide a golf club head with improved mechanical properties.

Still another object of the present invention is to provide a mold for a golf club head, wherein the mold has an opening to improve the strength of the mold and to improve the wax-releasing efficiency, increasing the good product ratio for the molds and shortening the casting procedure for the golf club head.

Yet another object of the present invention is to provide a method for manufacturing a golf club head.

SUMMARY OF THE INVENTION

A golf club head in accordance with the present invention includes a body, a hosel, and a heel. The heel has at least one opening. The golf club head is cast in a mold cavity of a mold. A striking plate is mounted to the body, and the hosel can be engaged with a shaft. The heel is formed between the striking plate and the hosel. The opening is so formed that the heel has a uniformly thin wall thickness. The mold cavity of the mold may include only one inlet, which forms a molding flow in a single direction during casting, improving the casting quality of the golf club head.

A better molding flow is provided in an area of the mold that is adjacent to the opening of the golf club head. The number of the inlet for the mold cavity is reduced, the casting quality of the golf club head is improved, and the production rate is increased. Another advantage of the single inlet for

the mold cavity is that it is apt to form a molding flow in a single direction such that the crystalline grains solidify uniformly, improving the mechanical properties of the golf club head. The mold has a mold hole in a position corresponding to the opening of the golf club head, which improves the strength of the mold and the wax-releasing efficiency, increasing the good product ratio for the molds and shortening the casting procedure for the golf club head.

Other objects, advantages and novel features of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a pattern assembly for manufacturing a conventional golf club head;

Fig. 1A is another pattern assembly for manufacturing a conventional golf club head;

Fig. 2 is a front view of a conventional golf club head;

Fig. 2A is an enlarged view of a circled portion in Fig. 2;

Fig. 3 is a front view of a golf club head of an embodiment in accordance with the present invention;

Fig. 4 is a pattern assembly for manufacturing the golf club head of the embodiment in accordance with the present invention;

Fig. 5 is a sectional view of the pattern assembly in Fig. 4;

Fig. 6 is a sectional view taken along plane 6-6 in Fig. 5 during a wax-releasing procedure;

Fig. 7 is a sectional view of the pattern assembly during casting;

Fig. 8 is a sectional view of a modified embodiment of the pattern assembly in accordance with the present invention;

Fig. 9 is a perspective view of another golf club head in accordance with the present invention;

Fig. 10 is a sectional view taken along plane 10-10 in Fig. 9; and

Fig. 11 is a sectional view of a pattern assembly for manufacturing the golf club head in Fig. 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention are now to be described hereinafter in detail, in which the same reference numerals are used in the preferred embodiments for the same parts as those in the prior art to avoid redundant description.

Referring to Fig. 3, a golf club head 20 of an embodiment in accordance with the present invention includes a body 21, a hosel 23, and a heel 22 having at least one opening 24. A striking plate 211 for striking a golf ball is mounted by insertion, pressing, brazing, soldering, or screwing to a front side of the body 21. Alternatively, the striking plate 211 and the body 21 can be integrally formed with each other. The hosel 23 includes an engaging hole 231 for engaging with a shaft (not shown). The heel 22 is formed

between the striking plate 211 and the hosel 23, thereby connecting the body 21 and the hosel 23.

The opening 24 in the heel 22 extends from a front side of the heel 22 through a rear side of the heel 22. The opening 24 is so formed that the heel 22 has a uniformly thin wall thickness. Namely, the wall thickness surrounding the opening 24 is preferably smaller than that of the remaining portion of the golf club head 20. Thus, the opening 24 advantageously improves the molding flow property during precision casting of the golf club head 20, thereby improving the casting quality of the golf club head 20. The principle of improving the casting quality by the opening 24 will be described in detail with reference to Figs. 4 through 7.

Referring to Fig. 4, before precision casting, a wax pattern 20' having a predetermined golf club head shape (of a golf club head 20) is produced. The wax pattern 20' has a wax hole 24' in a position corresponding to the opening 24 of the golf club head 20. A plurality of wax patterns 20' are aligned and attached to a feeder 1 and then immersed in zirconium slurry and stucco, forming a pattern assembly 10.

Referring to Fig. 5, the pattern assembly 10 includes a plurality of molds 11 each having a mold cavity 12, a single inlet 13, and a mold hole 14. The inlet 13 preferably faces a toe of the cavity 12, allowing effective use of space. The number of the molds 11 of the pattern assembly 10 is thus increased. A wall delimiting the mold hole 14 improves the green strength

before sintering, avoiding damage to the pattern assembly 10 during transportation. At this time, the respective wax pattern 20' remains in the respective mold 11.

Referring to Fig. 6, when releasing wax, the respective mold 11 is heated by steam to dissolve the wax pattern 20'. An external passage 14a is defined in the wall delimiting the mold hole 14 of the respective mold 11. The external passages 14a allows passage of the steam, increasing the heat exchange area for the steam and improving the wax-releasing efficiency. Further, the wax hole 24' of the respective wax pattern 20' reduces the overall amount and flow of liquid wax, which shortens the wax-releasing process.

Referring to Fig. 7, during precision casting, molten iron is poured via a common inlet 101 of the pattern assembly 10 into the mold cavity 12 of the respective mold 11 for casting a golf club head 20. Since each mold cavity 12 has a mold hole 14, the inner space of the mold cavity 12 is uniformly thin, which improves the molding flow property in the mold cavity 12 while pouring the molten iron. Casting flaw in any portion of the golf club head 20 can be effectively avoided. In particular, the possibility of generation of shrinkage cavities (c.f. Fig. 2A) in the surface of the heel 22 of the golf club head 20 is reduced. Further, provision of the opening 24 allows the golf club head 20 to be manufactured with a single inlet 13. The molten iron is poured via the single inlet 13 into the respective mold cavity 12 and forms a molding flow in a single direction in the respective mold cavity 12. This is

advantageous to uniform alignment and oriental solidification of the crystalline grains. Further, the number of the molds 11 in a pattern assembly 10 is increased in a case that a single inlet 13 is defined in the respective mold 11. The overall production capacity is increased.

Fig. 8 shows a modified embodiment of the pattern assembly. In this embodiment, the inlet 13 of the respective mold 11 faces a sole of the mold cavity 12 of the respective mold 11. This reduces the depth for pouring molten iron and shortens the casting procedure of the golf club head 20. Thus, the present invention may be used with different processing needs.

Figs. 9 and 10 illustrate a modified embodiment of the golf club head in accordance with the present invention. In this embodiment, the opening 24 is communicated with a crown or blade of the mold cavity 12 of the respective mold 11 and with a sole of the mold cavity 12 of the respective mold 11. Namely, the opening 24 is in the form of a conic hole that tapers upwardly and that extends from a top side of the heel 22 through a bottom side of the heel 22. Thus, the opening 24 of the golf club head 20 provides a uniformly thin wall thickness in a front side and a rear side of the heel 22. Further, provision of the mold hole 14 in the respective mold 11 provides a uniformly thin thickness for forming a molding flow in a single direction, which improves the uniformity and orientation of the crystalline grains, improves the green strength of the respective mold 11, and improves the wax-releasing efficiency. Further, in a case that the inlet 13 faces the toe of the mold cavity 12, the

number of the molds 11 of the pattern assembly 10 is thus increased.

Referring to Fig. 11, since the diameter of the opening 24 of the golf club head 20 in Fig. 9 is smaller and thus disadvantageous to the immersing procedure, the wax pattern 20' for the golf club head 20 is engaged with a sand core 30 having a shape the same as that of the opening 24. Thus, after the wax-releasing procedure, the respective mold 11 of the pattern assembly 10 forms the opening 24 through provision of the sand core 30. The sand core 30 can also be used with the embodiment shown in Figs. 3 and 4.

While the principles of this invention have been disclosed in connection with specific embodiments, it should be understood by those skilled in the art that these descriptions are not intended to limit the scope of the invention, and that any modification and variation without departing the spirit of the invention is intended to be covered by the scope of this invention defined only by the appended claims.